Amendments to the Specification:

Please replace the paragraph starting at page 4, line 13 with the following replacement paragraph:

This invention utilizes selective transmission technology to provide a superluminal energy flow. Selective transmission technology actively selects the ~~high energy~~ wavefront components within a wavepacket for transmission through a Quantum barrier. The selective transmission technology or device accomplishes this by choosing a Quantum barrier, or air gap length, that selectively transmits only the ~~high energy portion~~ wavefront of a wavepacket. ~~These high energy components are located near the wavepacket front or wavefront.~~ The selective transmission device can then transmit these wavefront components more efficiently, giving these components a head start. These wavefront components contain Quantum information that is then used to completely reconstruct the wavepacket on the far side of the barrier before the energy of a free photon would have arrived on the far side. The transmitted wavefront information is used to completely reconstruct the wavepacket with energy borrowed from the vacuum on the far side of the barrier. The energy in the photon before the barrier must traverse the barrier at a speed that is FASTER than the vacuum speed of light. This is required to "pay-back" the energy borrowed from the vacuum on the far side of the barrier in a time that is equal to the time allowed by Quantum mechanics, or by the saturated Heisenberg energy borrowing uncertainty principle. This Quantum requirement along with the selective-transmission technology generates superluminal group velocities and superluminal energy flow. In summary, the chosen air gap length amplifies the front part~~, or high energy components~~ of the

A1 Cont.

A1 Concld.

wavepacket using energy borrowed from the vacuum and Quantum information provided by selectively transmitted wavefront wavepacket components to completely reconstruct the wavepacket on the far side of the Quantum barrier. This causes superluminal energy flow that is required to pay back the energy debt within the time required by Quantum mechanics. However, because of the time it takes to prepare the energy for superluminal transmission using selective-transmission technology the superluminal energy flow contains no superluminal classical-information.

Please delete the paragraph beginning at page 5, line 7.

~~If the single Preferred reference Frame (PF) has a small velocity, v(PF), relative to the selective transmission technology, then absolute causality requires that c(AB) = c - v(PF). The resulting vector tunnel time Δτ(AB) is proportional to 1/(1 + β(PF)). It turns out that this preferred reference frame is also defined by the cosmic microwave background radiation Doppler shift, where at the Earth β(PF) = 0.001237 ± 0.000002.~~

Please replace the paragraph starting at page 5, line 13 with the following replacement paragraph:

A2 Cont

~~The Preferred reference Frame equivalence to zero Doppler shift in the cosmic microwave background is measurable.~~ When the tunneling direction is in the direction of the red shift in the cosmic microwave background the tunneling time is shortest, and when the tunneling is in the blue shift direction the tunneling time is longest. ~~In addition, the motion of the Earth around the sun adds and subtracts from the Earth=s velocity relative to the cosmic microwave background preferred reference frame so that as the Earth rotates the tunneling direction, a~~

A2 Concld.

~~vector tunneling time daily oscillation and yearly oscillation can be determined.~~ Because the measured daily oscillation of the tunnel time is equivalent to the change in the vector vacuum velocity of light with tunneling direction and the tunneling direction is itself equivalent to the cosmic microwave background dipole direction created by the Doppler shift caused by the Earth's motion, the one-way light velocity can be measured.

Please replace the paragraph starting at page 5, line 26 with the following replacement paragraph:

A3

In light of the above, in one embodiment, the invention is directed to a superluminal transmitter device comprising a transmission source, a receiver, and a selective-transmission device for receiving the transmission from the transmission source and selectively transmitting only the ~~high energy~~ wavefront portion of the transmission ~~wavefront~~ through a barrier.

Please replace the paragraph starting at page 5, line 31 with the following replacement paragraph:

A4 Cont.

In a particular embodiment, the selective-transmission device comprises an air-gap barrier having proximal and distal ends formed from effective transmission barriers and an air gap disposed between the proximal and distal barriers such that a transmission from the transmission source enters the proximal end of the barrier tunnels across the air gap and exits the distal end of the barrier. In this embodiment, the length of the air-gap is dependent on the wavelength of the wave-packet transmission such that the length of the air-gap is adjusted to

A4 Concld.

efficiently transfer the ~~higher energy part~~ wavefront of the transmission wave-packet.

Please replace the paragraph starting at page 6, line 5 with the following replacement paragraph:

A5

In another particular embodiment, the transmission source comprises a ~~rasio~~ radio source in signal communication with a transmission antenna and the receiver comprises an amplifier in signal communication with a receiver antenna.

Please replace the paragraph starting at page 6, line 8 with the following replacement paragraph:

A6

In yet another particular embodiment, the invention is directed to a ~~speedometer and~~ compass, comprising using the selective transmission device to measure the vector velocity of light ~~relative to the absolute reference frame~~.

Please delete the paragraph starting at page 6, line 14.

~~In still yet another particular embodiment, the invention is directed to a method for measuring the velocity vector of light. The method comprising measuring the oscillation in the tunneling time using a selective transmission system as described above.~~

Please delete the paragraph starting at page 6, line 18.

~~In still yet another particular embodiment, the invention is directed to a method for calibrating temporal data. The method comprising measuring the oscillation in the tunneling time using a selective transmission system as described above.~~

Please replace the paragraph starting at page 7, line 19 with the following replacement paragraph:

A transmission wavepacket **20** having a wavefront component ~~and an energy component~~ is introduced into the selective-transmission device **14** from the transmission source **12** such that the transmission wavepacket **20** is conducted through the space between the transmission source **12** and the receiver **16** to the monitor **18** at velocities faster than the speed of light. The selective-transmission device **14** is placed in proximate relation to the transmission source **12** such that the transmission wavepacket **20** passes through the selective-transmission device **14** and the wavefront component of the transmission wavepacket **20** is transmitted into the receiver **16** creating a signal. A receiver or series of receivers **16**, are adapted to receive the signal and transmit the signal to a monitor **18** in signal communication therewith. Any device having the ability to detect changes in amplitude, frequency, phase or wavelength of the transmission **20** can be used as a receiver **16** and monitor **18**, such as, for example, a radio amplifier in signal communication with an oscilloscope or a Time to Digital Converter (TDC). Additionally, any suitable transmission source **12** may be used in the subject invention, such as, for example, ~~a optical laser,~~ a microwave generator or a radio transmitter so long as detectable levels of electromagnetic radiation are transmitted to the receiver **16** in the form of a transmission wavepacket **20**.

A7

Please replace the paragraph starting at page 8, line 4 with the following replacement paragraph:

A8 Cont.

In general terms, the selective-transmission device **14** comprises a quantum air-gap barrier **22**, which is in signal communication with the transmission source **12**. The quantum air-

A8 Cont.

gap barrier **22** comprises a proximal **24** and distal **26** barrier wall and an air-gap **28** having a tunneling, or air-gap, length **30** disposed therebetween. The proximal barrier wall **24** is in signal communication with the transmission source **12** and the distal barrier wall **26** of the air-gap barrier **22** is in signal communication with the receiver **16**. The transmission **20** from the transmission source **12** interacts with the air-gap barrier **22** which selectively transmits the ~~high energy~~ wavefront component of the transmission wavepacket **20** across the air-gap **28** to the receiver **16** at ~~superluminal~~ subluminal velocities. The air-gap barrier **22** generates superluminal transmission velocities in the ~~high energy~~ wavepacket group component of the transmission **20** by selecting the ~~high energy~~ wavefront component of the transmission wavepacket **20** and more efficiently transmitting that ~~high energy~~ wavefront component across the air-gap **28**. The ~~high energy~~ wavefront component of the transmission wavepacket **20**, is selected by arranging the proximal **24** and distal **26** barrier walls such that the air-gap length **30** therebetween corresponds to quarter wavelength or multiples thereof of the ~~high energy~~ wavefront component of the transmission wavepacket **20**. By selecting the air-gap length **30** to correspond to the wavelength of the ~~high energy~~ wavefront component of the total transmission wavepacket **20**, the air-gap barrier **22** provides the ~~high energy~~ wavefront component of the transmission wavepacket **20** a head start, in effect causing tunneling of the ~~high energy~~ wavefront component, or tunneling transmission across the air-gap **28** in a tunneling time that is independent of the tunnel distance, or air-gap length, **30** ~~according to the Hartman effect~~, thus causing the tunneling transmission to cross the air-gap **28** at a superluminal group velocity. Any air-gap barrier **22** construct suitable for selecting the ~~high energy~~ wavefront component of the

A8 Concl.

transmission wavepacket **20** from a transmission source **12** and transmitting the ~~high energy~~ wavefront component of the wavepacket **20** across an air-gap **28** at ~~superluminal~~ subluminal velocities with a headstart causing superluminal group velocities may be used such as, for example, ~~optical mirrors for visible light transmissions,~~ square metal waveguides for microwave transmissions or tanks ~~of~~ having a high index of refraction substance such as water for radio transmissions.

Please replace the paragraph starting at page 8, line 34 with the following replacement paragraph:

A9

In one preferred embodiment, a radio transmission source **12**, a radio receiver **16** and an air-gap barrier **22** comprising a proximal tank **24** and a distal tank **26** aligned parallel to each other across an air-gap **28** are utilized to generate the superluminal transmissions. The proximal tank **24** is placed in signal communication with the transmission source **12** and the distal tank **26** is placed in signal communication with the receiver **16**. The tanks **24** and **26** are arranged such that an air-gap **28** is created between having an air-gap length **30** ~~corresponding to a quarter wavelength of the high energy component of the transmission wavepacket 20~~. In this embodiment, the tanks **24** and **26** may have any index of refraction suitable to act as a quantum barrier such as, for example, a ~~plexiglass~~ Plexiglas™ tank filled with water.

Please replace the paragraph starting at page 9, line 11 with the following replacement paragraph:

A10 cont.

To transmit the transmission wavepacket **20** to and from the selective-transmission device **14**, the transmission source **12** and receiver **16** must be positioned relative to selective-

A10 Concld-

transmission device **14** such that the transmission wavepacket **20** passes through the selective-transmission device **14**. In the embodiment shown in the attached figures, a radio transmission source **12** and a radio receiver **16** utilize antennas **32** directed at the selective-transmission device **14**. However, any suitable design can be used such that the transmission **20** from the transmission source **12** passes through the selective-transmission device **14** and enters the receiver **16**. ~~For example, focusing optics can be used to direct a visible light transmission **20** from a laser transmission source **12** through a selective-transmission device **14** to a photomultiplier receiver **16**.~~

Please replace the paragraph starting at page 10, line 17 with the following replacement paragraph:

A11 Cont.

FIGs. 2 to 7 show the results of a typical superluminal transmission absent a signal pulse for the superluminal transmission device prototype **10** shown in FIG. 1. During a transmission, the source amplifier **36** gain is set at the minimum level and the FM trap is turned ~~off~~ on. The cable lengths are adjusted such that the pulser **34** trigger pulse arrives at the oscilloscope monitor **18** just prior to the transmission wavepacket wavefronts **20**. Each transmission measurement contains 128 samples, averaged by the oscilloscope monitor **18**. The source data, or standard is taken with only the proximal barrier wall **24** in place. All error bars are the standard deviation of five data set measurements. FIG. 2 shows data from a source wavepacket measurement. The measured peak to peak time, τ_m, for the source wavepacket is 7.6 ± 0.1 ns, giving a photon wavelength of 228 cm. The large pulse shown below 0 peaking time, τp, is the pulser trigger which is the rising edge

A11 Concld.

set at -0.4 volts. The peaking time of the source wavepacket, τp, relative to the pulser trigger is 39.0 ± 0.3 ns. Table 1, below, shows the peak to peak separation times of the various components of the transmission wavepacket **20**. As shown for peak numbers 1 to 3, the higher energy, or lower wavelength, components are in the front part, or nearer the wavefront, of the transmission wavepacket **20**. It is these ~~high energy~~ wavefront components of the transmission wavepacket **20** that are selectively transmitted by the superluminal transmission device **10** described above.

Please replace the paragraph starting at page 11, line 12 with the following replacement paragraph:

A12 Cont.

In FIG. 3, the transmitted energy, E_T (mV^2), averaged over time, $<E_T>$, from 0 to 80 ns, is shown verses the air-gap length, L (cm). The maximum transmitted energy, E_T, over 0 to 80 ns occurs at an air-gap length of 57 cm. This energy peak is identified as a 228 cm photon quarter wavelength, indicating that the shorter air-gap lengths transmit the quarter wavelength or higher energy components of the transmission wavepacket **20** more efficiently. This is the mechanism that preferentially selects the front part, ~~or high energy~~ components, of the wavepacket **20** for transmission and generates the superluminal group velocities shown for a 30 cm air-gap length **30**. The tunneling time, $\Delta\tau$ (ns), is also shown verse the air-gap length, L (cm), in FIG. 3. The flat tops of the shaded boxes identify the regions where the tunneling time is independent of the tunnel, or air-gap, length **30**. ~~This is a demonstration of the~~

A12 Cont'd.

~~Hartman effect discussed above.~~ As previously described, the tunneling time is defined by the "energy borrowing" Heisenberg uncertainty principle of Equation (3), where the energy must be "paid back" in a time less than the tunneling time regardless of the energy flow speed or group velocity required. The wavepacket **20** that tunnels through the air-gap **28**, peaks prior to the source, or non-tunneling, wavepacket. The measured peaking time difference is defined by the equation:

Please replace the paragraph starting at page 12, line 24 with the following replacement paragraph:

A13

FIG. 4, shows a graph plotting the transmission fraction and tunneling time for a 204 cm wavelength photon verses the air-gap length. The boxes in the figure again show the regions where the tunnel time is independent of the tunnel length. This plot also shows that those regions where the tunnel time is independent of the tunnel length coincide with the selective transmission of the wavepacket front~~, the 204 cm, or high energy, wavepacket components~~. Thus, selective transmission of the ~~high energy~~ wavefront component of the transmission wavepacket **20** causes superluminal group velocities in those transmitted components.

Please replace the paragraph starting at page 12, line 32 with the following replacement paragraph:

A14 Cont.

FIG. 5 graphically shows the effect of this selective transmission. Data for this graph was taken from one 128 sample source data set for an air-gap length of 220 cm. In this measurement a 204 cm wavelength ~~wavepacket~~ wavefront **20** with a transmission fraction of 0.997 is utilized and the wavepacket

A11 Concld.

front is being actively selected. The straight bold line shows the vacuum speed of light, while the bent bold line depicts the subluminal speed of the selective transmission of the ~~high-energy~~ wavefront component of the wavepacket **20**. As shown, the selective transmission creates subluminal velocities in the ~~high-energy~~ wavefront components that are much less than *c* but not enough less to hold the energy luminal because they have a headstart. In mathematical terms, the stationary phase tunnel time, τ_s, given by:

$$\tau_s = \partial\phi / \partial\omega \qquad (6)$$

added to the head-start time, τ_h, caused by selecting the ~~high-energy~~ wavefront wavepacket components equals the group velocity tunnel time, $\Delta\tau$. The stationary phase tunnel time, give by Equation ~~8~~ 6, is τ_s = 46.18 ns, its peak (or group) value. The head-start time is defined by the equation:

$$\tau_h = \Delta\tau - \tau_s \qquad (7)$$

where, τ = 5.73 ns, and τ_h = -40.45 ns. Under these conditions the head-start time is also defined by the equation:

$$\tau_h = \tau_g - \tau_{psource} \qquad (8)$$

where, τ_h = -40.56 ns. Indicating that by selecting these ~~high-energy~~ wavefront components **42** a 40.56 ns head-start can be generated in the transmission, advancing the energy 1.6 ns for superluminal energy flow.

Please replace the paragraph starting at page 14, line 6 with the following replacement paragraph:

A15

FIG. 8 shows a measurement of the daily oscillation of the centroid time (which is used to define the tunneling time which is equivalent to the change in the vector vacuum group velocity of light) with tunneling direction. This tunneling direction is in turn equivalent to the cosmic microwave background dipole direction created by the Doppler shift caused by the Earth's motion. Accordingly, the one way light velocity and Reichenbach coefficients can be measured.

Please replace the paragraph starting at page 14, line 11 with the following replacement paragraph:

A16

~~As a short explanation, the single Preferred reference Frame (PF) has a small velocity, v(PF), relative to the selective transmission technology, then absolute causality requires that c(AB) — c - v(PF). The resulting vector tunnel time Δτ(AB) is proportional to 1/(1 + β(PF)). It turns out that this preferred reference frame is also defined by the cosmic microwave background radiation Doppler shift, where at the Earth β(PF) = 0.001237 . 0.000002.~~ The Doppler redshift direction vector ~~β(PF)~~ points in the direction of declination 7.22□ closest to the sun on March 7^{th} with a right ascension of 23.20 h and is in the opposite direction to the Earth's motion that causes the cosmic microwave background Doppler shift.

Please delete the paragraph starting at page 14, line 20.

~~The Preferred reference Frame equivalence to zero Doppler shift in the cosmic microwave background is measurable. The theoretical vector tunneling time utilizing this selective transmission technology is Δτ(AB) = Δτ . 7.08 . 0.57 ps where the Doppler shift defines the . 7.08 ps of daily oscillation and the . 0.57 ps is yearly oscillation and is a measure of the Earth=s motion around the sun.~~

Please replace the paragraph starting at page 14, line 25 with the following replacement paragraph:

A17

The measured daily oscillation of the tunnel time is equivalent to the change in the vector vacuum group velocity of light with tunneling direction. When the tunneling direction is in the direction of the red shift in the cosmic microwave background the tunneling time is shortest ~~or plus 7.08 ps~~. When tunneling is in the blue shift direction the tunneling time is longest ~~or plus 7.08 ps~~.

Please replace the paragraph starting at page 14, line 30 with the following replacement paragraph:

A18

The measured daily oscillation of the tunnel time is due to a change in the vector vacuum group velocity of light c(AB), as a function of tunneling direction (AB), and the Reichenbach clock coefficients, as described in Equations (1) and (2). Utilizing the ~~protoype~~ prototype system, the one-way light group velocity can be measured and compared with these theoretical values.

Please replace the paragraph starting at page 15, line 2 with the following replacement paragraph:

A19 Cont.

~~It is found that measurements taken with the prototype track these theoretical values.~~ The vector vacuum phase velocity of light was measured at an air-gap length of 220 cm. FIG. 8 shows a histogram mean value data of the centroid ~~tunneling~~ time over a twenty-four hour period of measurement. The 9308 has a histogramming bin width of 1.22 ps over the 80 ns window. At L = 220 cm, the standard deviation lower bound, $\Delta\tau(\min)1 = \Delta X/2c = 507ps$, requiring millions of pulser pulses to

decrease the error in the centroid ~~tunneling~~ time histogram mean value below a picosecond. ~~In order to maximize the group delay time the~~The 9307-discriminator level was set as high as possible without effecting the count rate. The tunneling direction was parallel to the Earth's surface at 108º, fixing the tunneling direction declination at -12º. A typical data set showing peak time ~~statistic~~ statistics in ns for ten spectrum centroids is summarized in Table 3, below:

A19 Concld.

Table 3: ~~Tunneling Time~~ Centroid Time Oscillation Data	
Mean	47.010
Median	47.011
RMS	47.010
Standard Deviation	0.0029258
Variance	8.5604 e^{-6}
Standard Error	0.00092523
Skewness	1.0718
Kurtosis	0.97325

Please replace the paragraph starting at page 15, line 27 with the following replacement paragraph:

A20 cont.

~~As described above, the cosmic Doppler shift defines the theory line shown in FIG.8.~~ As the measured daily oscillation of the centroid ~~tunnel~~ time is equivalent to the change in the vector vacuum phase velocity of light with tunneling direction,

A20 Cncld.

and as the tunneling direction is equivalent to the cosmic microwave background dipole direction created by the Doppler shift caused by the Earth's motion, the one way light phase velocity is measured, and the Reichenbach clock synchronization ~~coefficient~~ coefficients can be determined ~~as: β(QH) = 0.001237 ± 0.000002 in the 23.20h right ascension and 7.22° declination direction in the Doppler red-shift direction~~.

Please replace the paragraph starting at page 16, line 2 with the following replacement paragraph:

A21

Although the above embodiment was only utilized to measure the one way light phase velocity, it will be obvious to one of skill in the art that other uses for the oscillating tunneling time measurements could be made. For example, using the tunneling time oscillation to ~~calibrate data in the time domain~~ measure the group velocity of light. ~~It is clear that by knowing that a predictable and computable oscillation exists in temporal data, a calibration factor can be determined and utilized to calibrate that temporal data utilizing the invention~~. In addition, the vector group velocity of light can be used as a ~~speedometer and~~ compass relative to the ~~absolute reference frame~~ cosmic background Doppler redshift direction or as a clock and calendar by also knowing the Earth's motion.

Please delete the paragraph starting at page 16, line 11.

~~In addition, the measured preferred reference frame equivalence to the cosmic microwave background preferred reference frame is very aesthetic. This measured equivalence begins the new science of ARadio Cosmology@. It will be understood that as the special theory of relativity becomes more complicated to accommodate absolute causality, Minkowski space-time gives way to, the Amore natural@ Lorentz frame bundle with~~

~~its base space of preferred frame velocities. This Amore natural@ frame bundle language should be explored using more accurate ARadio Cosmology@ measurements. For example, more accurate measurements are required to confirm Lorentz over Galilean symmetry using only tunneling time data~~

Please replace the abstract starting at page 19 with the following replacement abstract:

A2

A device, system and method for measuring the one-way velocity of light using selective transmission technology to provide a superluminal energy flow is provided. The superluminal transmitter comprises a transmission source, a receiver, and a selective-transmission device for receiving the transmission wavepacket from the transmission source and selectively transmitting the ~~high energy or~~ wavefront component of the transmission wavepacket through a barrier such that the energy transmission tunnels through the barrier at superluminal group velocities. The measured daily oscillation of the tunnel time can then be utilized to measure the one way light velocity. A system and method for measuring the vector phase or group velocity of light using the superluminal transmitter system of the invention is also provided as well as a ~~method of calibrating temporal data and a~~ device which can be utilized as ~~a speedometer,~~ a compass, a calender and/or a clock.